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A STUDY OF THE CLUSIODIDÆ, (HETERONEURIDÆ) OF THE EASTERN UNITED STATES.

By Charles W. Johnson.
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Since the publication of the "Revision der Heteroneuriden" by P. Leander Czerny (Wien. Ent. Zeit. XXII, 61, 1903), it has been apparent to the writer that there were many discrepancies and errors in the determination of the American species. The want of material, however, has caused me to hesitate in attempting to define our species more clearly. It seems imperative that these errors should be corrected and brought to the attention of future workers.

The species seem to separate quite readily into the genera described by Czerny and Coquillett, based on the arrangement of the cephalic bristles, and later tabulated by Dr. Williston in his "Manual of North American Diptera."

Clusiodes Coquillett.

For the genus Heteroneura Fallen 1823, not 1810, Coquillett proposed the genus Clusiodes 1904, Type *H. albimana* Meigen. The four species belonging to this genus may be tabulated as follows:

1. Wing with the clouding on the anterior portion confined to the apical third . . . 2
   Wing with the clouding extending from the end of the first vein *geomyzina* Fall.
2. Legs with the anterior tarsi more or less black 3
   Legs entirely yellow; face of the ♂ black . . . . . *melanostoma* Loew.
3. First, or the first two anterior tarsal joints black, the others white *albimana* Meig.
   All of the anterior tarsal joints in the ♀ and the last three or four joints in the ♂ black . . . . . *pictipes* Zett.

Clusiodes geomyzina Fallen.

Heteroneura geomyzina Fall., Agromyz. 2. 2. 1823; Czerny, Wien. Ent. Zeit., XXII, 77, Taf. I, f. 1, 2 and 4, 1903.

One specimen was taken by the writer at Machias, Me., July 19, 1909, the first American record.

Clusiodes melanostoma Loew.

Heteroneura flavifacies Coq. MS. in Mrs. Slosson's List of Mt. Washington Insects, Ent. News, VIII, 239, 1897, not "Smith's New Jersey Cat.," as stated in Aldrich's Cat., p. 570.

The fourteen specimens before me show the following distribution: Maine—Northeast Harbor, July 12 (Dr. C. S. Minot) and Machias, July 19, 21 (C. W. J.); New Hampshire—Franconia and Mt. Washington (Mrs. Slosson); Vermont—Norwich, July 7, and Mt. Ascutney, July 11; Massachusetts—Auburndale, June 15, 21, Mt. Greylock, June 15, and Chester, May 26, 28 (C. W. J.); Montreal, Can., July 14, (Beaulieu).

Clusiodes albimana Meigen.

Thirteen specimens show the following distribution: Maine—Capens, Moosehead Lake, July 14 (C. W. J.); New Hampshire—Intervale, August 23 (G. M. Allen); Vermont—Burlington, June 24, St. Johnsbury, July 28, Norwich, July 8, Mt. Ascutney, July 11, and Manchester, June 4; Massachusetts—Washington, August 8, Bash Bish Falls, June 27 (C. W. J.); New Jersey—Delaware Water Gap, July 12; Canada—Rouville County, Quebec (G. Chagnon).

Clusiodes pictipes Zetterstedt.

Mt. Washington, N. H., Coquillett in Mrs. Slosson's List of Mt. Washington Insects (Ent. News, VIII, 239, 1897). The occurrence of this species in North America is somewhat doubtful.

Heteromeringia Czerny.

The following species, placed under this genus, are distinguished by the absence of frontal cross bristles. The four species may be separated by the following table:

1. Species in which yellow predominates 2
   Species entirely black 3
2. Thorax entirely yellow, cephalic bristles yellowish ..... *flaviseta* sp. nov.
   Thorax with a large black lateral spot or stripe, cephalic bristles black
   latifrons Loew.
3. Anterior legs entirely yellow, posterior femora and tibiæ annulated; wing clouded beyond the end of the fifth vein ..... *annulipes* sp. nov.
   Anterior tibiæ and tarsi, and apical half of the femora black; wing clouded before the end of the fifth vein ..... *nitida* sp. nov.

Heteromeringia latifrons Loew.

Heteroneura latifrons Loew., Wien. Ent. Monatssch., IV, 82, 1860.

Twelve specimens show the following distribution: Massachusetts—Auburndale, August 13, Weston, July 23, Chester, August 7; New Jersey—Delaware Water Gap, July 15; Pennsylvania—Lake Ganoga, North Mt., August 29.

Heteromeringia flaviseta, sp. nov.

Female: Face, cheeks and lower half of the occiput whitish, front and upper half of the occiput light yellow, antennæ and a space above their base, fulvous yellow, arista blackish; frontal and vertical bristles yellowish. Thorax, scutellum, and metanotum yellow, humerus, pleura and coxæ white. Abdomen yellow, the tip of the fourth, all of the fifth, and the dorsal portion of the sixth segment, brownish black, tip of the last segment margined with white, ovipositor yellow. Halteres and legs yellowish white. Wings yellowish hyaline, apical third slightly clouded, especially near the veins. Length 4 mm.

Two specimens. Holotype, New Brunswick, N. J., May 28 (Dr. J. B. Smith). Paratype, Ft. Lee, N. J. Types in the author's Collection.

Heteromeringia annulipes sp. nov.

Face and cheeks white, lower part of the front and orbits yellow; upper part of the front, the vertex and occiput black, palpi and antennæ yellow, apical half of the third joint and arista dark brown. Thorax, upper half of the pleura, scutellum, metanotum, and abdomen, shining black; lower half of pleura, legs and halteres yellowish white; tip of the posterior femora and tibiæ annulated with dark brown. Wings hyaline, apical third, and a small area at the anterior cross-vein, and end of the discal cell, slightly clouded with smoky black. Length 3 mm.

One specimen, Murfreesboro, Hertford County, N. C., June 9, 1895. Type in the author's collection. This species resembles *Heteroneura flavipes* Will., but the annuli on the posterior legs and the apical clouding of the wing, which is entirely beyond the end of the fifth longitudinal vein, readily distinguish the species.

Heteromeringia nitida sp. nov.

Male: Face yellowish, orbits whitish pruinose, cheeks shining black; front black, opaque, vertex shining; antennæ yellowish, tip of the third joint and arista dark brown. Thorax dull black, pleura and abdomen shining black; legs yellow, the anterior legs except the coxæ and basal half of the femora, black, base and tip of the posterior tibiæ dark brown. Halteres white. Wings smoky, darker along the anterior portion beyond the middle and near the cross veins. Length 3 mm.

The female differs but little from the male except that the front is entirely shining black. Length 3.5 mm.

Three specimens. Holotype and allotype from Goose Neck, near Long Branch, N. J., June 12, 1902. Paratype, Riverton, N. J., May 14. All are in the author's collection.

In the "Insects of New Jersey" this was erroneously referred to *Heteroneura pictipes* which it resembles superficially and, barring the absence of the frontal "cross bristles," agrees fairly well with the description of that species. It is also closely allied to *Heteromeringia nigrimana* Loew. but the shining black cheeks and white halteres seem to separate it from that species.

Clusia czernyi sp. nov.

Male: Upper half of the face black, orbits and lower half including the cheeks, white, proboscis and palpi white, front yellow, antennæ light yellow, arista and ocelli black. Thorax yellow, pleura with a wide, black, shining stripe extending from the neck to the base of the abdomen, the rest of the pleura and sternum yellowish white. Abdomen yellow with wide lateral stripes of black. Legs yellowish, base of the femora and the coxæ white, base of the posterior tibiæ brownish, halteres white. Wings grayish hyaline, with a middle and apical band of black, broadly connected by a band filling all of that portion of the marginal and submarginal cells. Length 5 mm.

Female: Face yellow with two black stripes extending from the base of the antennæ to the oral margin, tips of the palpi black. The broad lateral stripes of the abdomen are interrupted at the fifth segment. Ovipositor yellow. Length 6 mm. In other respects resembling the male.

Seventeen specimens. Holotype and allotype, Northeast Harbor, Me., July 1, 1909 (Dr. Charles S. Minot). In the collection of the Boston Society of Natural History. Paratypes, Northeast Harbor, Me., June 3, July 4, 19 and 23 (Dr. Minot), Eastport, Me., July 15, Mt. Equinox, Vt., June 5, Chester, Mass., May 25 and 27, and North Mt., Pa., June 8, 1898 (C. W. Johnson); Franconia, N. H. (Mrs. A. T. Slosson); Holland, N. Y., May 21 (M. C. Van Duzee); Sport Island, Sacandaga River, N. Y., June 16, 1910 (C. P. Alexander).

This species has been confused with *C. lateralis*, from which it can be readily separated by the double banding of the wings and the broader and more continuous lateral abdominal stripes. Both species have a similar distribution but *C. lateralis* usually appears somewhat later in a given locality. At Chester, Mass., *C. lateralis* was common in August but was not observed in May.

Clusia lateralis Walker.

Heteroneura spectabilis Loew., Wien. Ent. Monatschr. IV, 82.

The nineteen specimens before me show the following distribution: Maine—Northeast Harbor, July 4 (Dr. C. S. Minot); Vermont—Norwich, July 7, Burlington, June 23, and St. Johnsbury, June 27; Massachusetts—Auburndale, August 9, Chester, August 4–7, and Bash Bish Falls, June 27; Connecticut—Middletown, June 19; New Jersey—Riverton, July 6; Pennsylvania—Folsom, June 12, and Glenside, May 26 (C. W. Johnson); Canada, (Beaulieu), July 16.

Chætoclusia affinis sp. nov.

Male: Head light yellow, palpi and antennæ yellow, arista black, densely plumose, ocelli black. Thorax yellow, abdomen brownish, tip yellow. Legs yellow, anterior tibiæ and tarsi brown. Halteres yellow. Wings yellowish hyaline. Length 2.5 mm.

Female: Similar to the male except that the anterior tibiæ and tarsi are black and the abdomen shining with an obscure dorsal line and black tip. Length 3 mm.

Holotype, Riverton, N. J., June 18 (C. W. J.); allotype, Jamesburg, N. J., July 15 (J. B. Smith). Both in the author's collection.

The Jamesburg specimen was referred doubtfully to *Clusia flava* Meig. in Smith's Insects of New Jersey. The Fort Lee specimen also referred to that species is *H. flaviseta*. As this is the only American record for *C. flava*, it should be omitted from the list of North American Diptera.

ON THE TRIBE DEJEANIINI OF THE MUSCOID FAMILY HYSTRICIIDÆ, WITH FIVE NEW GENERA.

By Charles H. T. Townsend,
Director of Entomological Stations, Lima, Peru.

The Dejeaniine flies are among the most striking and interesting of the muscoid group. They are characterized not only by a general strong macrochætal development showing in more or less densely placed spines on the abdomen and scutellum, which they share with many other forms of the *Hystriciidæ*, but also by the unique development of the palpi which are greatly elongated.

The tribe as so far known to the writer divides naturally into the four subtribes *Dejeaniina*, *Paradejeaniina*, *Lasiopalpina* and *Dejeaniopina*, the last three being monotypic. Only the last two have pilose eyes. The *Dejeaniina* divide into three group-units, the *Dejeaniiæ* with discal spines on intermediate abdominal segments and normal palpi, the *Eulasiopalpiæ* without discal spines and with ciliate palpi, and the *Eudejeaniiæ* without discal spines and with normal palpi. *Dejeania* was founded by Robineau Desvoidy in 1830, who included therein at the time the two species *brasiliensis* RD. and *capensis* RD., but without designating either as the type. In 1910 Coquillett designated the latter, which equals *Stomoxys bombylans* F., as type of the genus. *Lasiopalpus* was founded by Macquart in 1847, with the single species *flavitarsis* Mcq. which is thus the type. *Eudejeania* was founded by the writer in 1912, with designation of *subalpina* T. as type.

All the Dejeaniine flies known up to twenty years ago, other than *Lasiopalpus*, were grouped under the single genus *Dejeania*. Brauer and von Bergenstamm were the first to cut any of the forms loose from this combination, characterizing the genus *Paradejeania* in 1893 for *Dejeania rutilioides* Jaennicke and *Jurinia myrrhea* Say, BB. As the latter is a *momen nudum*, the former stands as the type of the genus. In 1898 Brauer added to the genus, *Jurinia hystrix* Riley (nec F., nec Will.) MS from North America, *Jurinia amethystina* Macquart from Brazil (Minas-Geraës), *Jurinia bicolor* Macquart (nec Wd.) from Colombia and Cayenne (two species, probably MS in coll.), *Jurinia nigricalyp-*

trata Macquart from Brazil (Minas-Geraës), and *Hystricia erythrina* Bigot from Brazil (Bahia). The remainder of the forms continued under the old genus until 1912, when the writer established the genus *Eudejeania* for certain strikingly large and distinct forms which range high in the Andean montanya.

The African *Dejeania capensis* RD. (equals *bombylans* F., Wd.) is not congeneric with any of the American forms, hence its designation as type of the genus leaves the latter without nearer generic reference than *Eudejeania*, which is strikingly contrasted with the older and better known forms. The figure 21, on page 44 of the third edition of Dr. Williston's Manual, labeled *Paradejeania* sp., is evidently not that genus. It has almost exactly the form and aspect of *Eudejeania* female; if discal spines are wanting on the intermediate abdominal segments (they appear to show on the left side of second segment), and the proboscis and palpi are both very elongate, it is probably *Eudejeania*. The figure 60, on page 366 of same work, also labeled *Paradejeania* sp., is neither *Paradejeania* nor *Eudejeania*, but has the palpal characters of *Jurinia*.

Tachina armata Wiedemann was taken by Brauer and von Bergenstamm in 1889 as typical of the American forms, and is here made the type of the new genus *Adejeania*. *Tachina corpulenta* Wiedemann and *Dejeania vexatrix* Osten Sacken are strikingly contrasted with *Adejeania* and the other American forms, the second showing an approach to *Servillia* in its long dense pubescence and the first exhibiting bristles in place of this pubescence. Both are made the types of new genera. *Eulasiopalpus* is erected for forms with ciliate palpi, long proboscis and bare eyes. The following synoptic table will show the distinctions between all of these forms with greatly elongated palpi, including the new genus *Dejeaniops* Townsend whose characterization is given in full in a forthcoming paper on the *Hystriciidæ* of the Andean montanya.

Table of Tribe Dejeaniini.

1. Eyes thickly pilose, third antennal joint straight on front border and widened-subtruncate apically 2
   Eyes practically bare, third antennal joint more or less convex on front border and always rounded apically 3
2. Palpi long and narrow, of even width except on the more narrowed base, not ciliate; proboscis elongate and slender; parafacials hairy; abdomen subovate and gently emarginate anally, no discal spines on intermediate segments; front

tarsi of female not conspicuously widened (Dejeaniopina)
Dejeaniops gen. nov.

Palpi much widened on apical half, gradually narrowing basally, densely ciliate with long hair; proboscis short and stout; parafacials bare; front tarsi of female strongly widened (Lasiopalpina) ..... *Lasiopalpus* Mcq.

3. Palpi narrow, gradually narrowing basally, ciliate with long hair; proboscis slender and conspicuously longer than head-height; parafacials hairy; abdomen emarginate anally (Dejeaniina: Eulasiopalpiæ) ... *Eulasiopalpus* gen. nov.

Palpi not ciliate 4

4. Palpi gradually widened from base distally, proboscis short; abdomen subquadrate and conspicuously emarginate anally; front tarsi of female strongly widened (Paradejeaniina) ..... *Paradejeania* B. & von B.

Palpi of even width on distal two-thirds or more; proboscis elongate and slender (Dejeaniina: Dejeaniiæ and Eudejeaniiæ) 5

5. Discal spines on dorsum of intermediate abdominal segments (Dejeaniiæ) *Dejeania* R.D. (Africa)

No discal spines (Eudejeaniiæ) 6

6. Abdomen subquadrate and deeply emarginate or buttocks-like behind in both sexes; front tarsi of female widened ..... *Eudejeania* T.

Abdomen subovate, not broadly buttocks-like behind, at most the hind border of anal segment half as long as greatest width of abdomen and gently emarginate in female; front tarsi of female not widened 7

7. Abdomen clothed with strong bristles in addition to the spines and differentiated therefrom, front tarsi of male with bristly hairs on inside
Echinotachina gen. nov.

Abdomen with only pubescence in addition to the spines 8

8. Pubescence short and normal ..... *Adejeania* gen. nov.

Pubescence long, dense, even and pronounced, showing conspicuously among the spines, thorax also with a dense pubescence .... *Trichodejeania* gen. nov.

Below is a statement of the genera and their types. Whether all these forms belong in one natural tribe remains to be decided by a careful intensive study of the group and its allies. Although it would seem probable that these elongate palpi are not all of common origin, yet none of the forms exhibits any striking departure in its external anatomy from the general characteristics of the group. A comparative study of the first-stage maggots, which the writer has in hand, will conclusively demonstrate the actual affinities.

Dejeania R. D. (1830)—Type, *Stomoxys bombylans* F. (equals *Tachina bombylans* Wd., and *Dejeania capensis* R.D.).

Lasiopalpus Mcq. (1847)—Type, *L. flavitarsis* Mcq.

Paradejeania B.B. (1893)—Type, *Dejeania rutilioides* Jaen.

Eudejeania T. (1912)—Type, *E. subalpina* T.

DEJEANIOPS T. gen. nov.—Type, *D. ollachea* T. n. sp.

EULASIOPALPUS gen. nov.—Type, *Lasiopalpus albipes* T. n. sp.

ADEJEANIA gen. nov.—Type, *Tachina armata* Wd. (equals *Dejeania armata* BB.).

TRICHODEJEANIA gen. nov.—Type, *Dejeania vexatrix* O.S.

ECHINOTACHINA gen. nov.—Type, *Tachina corpulenta* Wd.

The following descriptions are abridged from the originals which will appear in the forthcoming paper on the *Hystriciidæ* of the Andean montanya.

Dejeaniops ollachea sp. nov.

Length, 11 mm. One female, Ollachea, San Gaban canyon, southeastern Peru, about 9,500 ft., Feb. 2 (Townsend). Head yellowish, faintly golden. Palpi rust-yellow, antennæ yellowish-brown to reddish, arista black. Parafrontals and thorax brownish-olive, scutellum pale. Abdomen soft black, with clear light yellow on sides of anterior two-thirds. Legs rust-yellow, femora largely blackish. Wings and tegulæ smoky, tegulæ thickly microscopically black-pubescent. Palpi and proboscis both very long and slender, parafacials and eyes pilose.

Lasiopalpus albipes sp. nov.

Length, 14 mm. One male, Huascaray ridge, northern Peru, about 7,000 ft., Sept. 22 (Townsend). Head smoky-silvery; epistoma, front, antennæ and palpi black or blackish. Thorax, scutellum, abdomen and femora black, tibiæ pale yellowish, tarsi yellowish-white. Wings infuscated, tegulæ smoky-black. The third antennal joint is rounded apically, eyes bare, parafacials hairy, and proboscis about one and one-fourth times head-height.

The following are descriptions of two new species of *Eudejeania* recently secured by the writer in the high Andean region of central Peru:—

Eudejeania punensis N. sp.

Length of body to ends of spines, 14 to 16 mm.; of wing, 11.5 to 13.5 mm.; of palpi, 3.5 to 4 mm.; width of abdomen, 7 to 8 mm. Fifty-two females and one male, Pachacayo valley, about 12,000 feet, in puna region about half way between Oroya and Jauja, Peru, March 27 and 28, 1913, on flowers of *Viguiera*-like composite. The immense preponderance of the females is worthy of remark.

Differs from *Eudejeania nigra* T. by its much smaller size and by the following colorational characters:—Legs with their spines, palpi and first two antennal joints rust-yellow, the second antennal joint more or less slightly smoky on base. Wings only lightly smoky, the veins rust-yellow giving the wing bases a distinct yellow tinge. Parafrontals dusky olive. Occipital pile pale brassy. Thorax and abdomen dark brown to black, showing smoky pollinose on anal segment in oblique view and somewhat less so on third segment.

Type, TD4135 (female fly, reproductive system, first-stage maggot). Has strap-like uterus and deposits blackish maggots, probably on foliage.

Eudejeania alpina n. sp.

Length of body to ends of spines, 20 mm.; of wing, 16.5 mm.; of palpi, 5 mm.; width of abdomen, 11 mm. Two females, Pachacayo valley, about 12,000 feet, with preceding species on same flowers, March 28, 1913.

Differs from *Eudejeania punensis* T. by its much larger size and by the following colorational characters:—Head deeply fuscous, practically black, only narrow orbits and wider border in front of eyes brassy. Antennae wholly black. Frontalia silvery to tawny pollinose in oblique view. Palpi yellowish or tawny, but deeply tinged with smoky. Occipital pile golden to brassy. Wings deeply smoky throughout including bases; veins brown to blackish, not showing yellowish to the unaided eye. Legs slightly deeper rust-yellow, the femora more reddish.

Type, TD4139 (female fly, reproductive system).

It should be noted here that the writer, in all of his collecting, has never before found such an abundance of Dejeaniine flies in the height of activity as that encountered at the above-mentioned locality in Pachacayo valley, forty-five of the above specimens having been taken there in an hour or so of fitful sun and rain during the forenoon of March 28. Hundreds of *E. punensis* could doubtless have been collected in the locality had sun and time permitted. An approach to such abundance, but in a state of dulled activity, was encountered in October, 1895, in the Sacramento Mountains of southern New Mexico (Ann. & Mag. N. H., 6th ser., vol. 19, No. 110, pp. 144–145).

A NEW BEE OF THE GENUS EMPHOR.

By T. D. A. Cockerell,
University of Colorado.

Mr. C. T. Brues has kindly sent me three females of a species of *Emphor*, collected by Miss Louise Nichols at Cape May Pt., N. J., Aug. 25, 1912. To my surprise, they are not *E. bombiformis* but represent a new species.

Emphor fuscojubatus sp. nov.

♀. Like *E. bombiformis* (a cotype from Georgia compared) but differing as follows: hair of vertex dark rufofuscous, instead of being ochreous like that of the thorax; hair of thorax paler, not so red; hair of middle of front fuscous instead of whitish; scape not red at apex; third submarginal cell conspicuously longer; hind margin of first abdominal segment narrowly pale and pellucid; wings perhaps rather paler.

This is probably the *Emphor bombiformis* of Smith's New Jersey list.

SOME OBSERVATIONS ON THE NESTING HABITS OF THE MINING BEE, *EMPHOR FUSCOJUBATUS* Ckll.

By M. Louise Nichols.

These observations were made during the last week of August, 1912, at Cape May Point, N. J., by Mr. Reynold A. Spaeth and myself. The bees collected were thought at first to be *Emphor bombiformis* Cress., but a closer examination by Prof. T. D. A. Cockerell revealed the fact that they were sufficiently unlike *E. bombiformis* to be classed as a new species, named by Prof. Cockerell *Emphor fuscojubatus*, and differing from the other species chiefly in the color of the hair on various parts of the body and in the greater size of the third submarginal cell of the wing. It is a member of the family Apidæ.

By the side of a road, for a distance of about one eighth of a mile, in soil consisting of a mixture of clay, sand and pebbles, numerous nest openings were discovered and between about ten A. M. and four P. M. many bees flying in and out. The nest is begun as a semicircular depression, the soil being moistened by a fluid from

the mouth, loosened by the mandibles, and ejected sidewise by the first and second pairs of legs. As the depression increases in depth, it is surrounded by a wall of the moistened earth, reaching a height of about one centimetre, the posterior end of the abdomen being used as a trowel in its construction.

At frequent intervals the bee stops work, and after an absence of thirty seconds or so, returns. Our curiosity aroused as to the reason for these frequent excursions, we followed one individual in her flight and were led to a small pond about seventy-five yards away. Here numerous bees were discovered floating on the surface with legs outstretched, presumably sucking up into their crops a supply of water for use in making the nest. By its aid the clayey soil is formed into pellets, passed under the body probably by means of the tibial spines and kicked out at the entrance by a sudden jerk of the last pair of legs, most comical in the impression it produces of business like intention. The force of the jerk is often considerable, as the pellets are thrown several inches from the mouth of the nest.

Less than twenty-four hours is occupied in the construction of the nest. One begun at twelve thirty P. M. was three inches deep at four, the same day. The following morning, between six-thirty and seven, the bee was observed entering, her hind legs and body heavily laden with flocculent masses of pollen. She remained within for one minute, presumably packing the pollen, came out and was gone for five to six minutes, returning again laden with pollen. Sometimes the load is so superabundant that fragments of it will be dropped on the ground near the entrance. If the weather were cloudy, the time was lengthened, more than ten minutes being required for collection of the pollen. After a final trip she remained within for a longer time, i. e., twenty minutes, possibly occupied in laying an egg. The nest is completed by gnawing away the raised rim of earth about the opening. Usually the surrounding pellets are also drawn in by the first pair of legs, the earth thus filling and closing the entrance. A nearly circular depression, however, marks the site, for the earth is not filled in level with the soil surface.

On digging the earth away from the nest cavity, a considerable mass of fermenting pollen of sour smell was found and on it a single, slightly curved egg, six mm. in length. The pollen is collected,

apparently only in the early morning hours, for no bees were seen bearing pollen in the middle or latter part of the day. Many plants were blooming in the vicinity, wild Compositæ and Leguminosæ, also cultivated sweet peas and morning glories, but none of them were visited by the bees. Since the heavy, sticky masses brought back by them resembled in appearance the pollen of *Hibiscus moschatus*, which grew abundantly in the swamps not far away, it was suspected that this plant might be the source of supply. A comparison under the microscope of Hibiscus pollen with some taken from a nest proved this to be the case.

Although the behavoir of the bees corresponds in general to the foregoing description, some variation was observed. As is often the case with solitary wasps, nests may be begun and abandoned before completion. The wall of earth around the entrance is more carefully built in some nests than in others, and the distance to which the pellets are thrown also varies. Individual differences in the ease with which the nest was recognized were also noticed. Some fly with astonishing directness and rapidity to the opening, while others alight at the wrong spot and appear confused. Bees sometimes enter nests not their own, and, on discovering the mistake, back hurriedly out. Before emerging it is usual for the insect to stop a moment at the opening, moving the head from side to side as if reconnoitring. Slight movement or noise in the neighborhood will cause her to jerk back into the nest, but after a short interval, she slowly reappears, again reconnoitres and flies off. Individuals differ in this respect also; some appear more timid than others.

On Nov. 29, I again visited the place, in order to determine if possible how the bees passed the winter. No trace remaining of the depressions marking the site of the nests, I was obliged to dig at random. The quest proved not entirely fruitless and three cocoons were obtained containing larvæ. The cocoon is made of densely woven silk entangling many left over pollen grains and lined with a brownish varnish-like substance, well adapted to keep out the dampness. The largest of the three measures a little over two centimetres (about twenty three mm. by thirteen, the smallest about thirteen mm. in each dimension and the third about sixteen mm. by thirteen mm. This last was broken in removing it from the soil. It contained a small larva not quite a centi-

metre long. The remaining two cocoons were buried in soil contained in a tin box and when next examined, Dec. 28, the larva within the larger cocoon was found dead. The small head, bearing distinct black jaws was bent under the body as was also the posterior end. The body nearly equalled in length the longer diameter of the cocoon. As the male of the closely related species, *E. bombiformis* is smaller than the female, the most probabl explanation of the difference in the size of the cocoons is that the larger ones contain females, the smaller ones males.

Since writing the foregoing, I have discovered in the Journal of the N. Y. Entomological Society for Dec. 1911, an article entitled "Contributions toward the Life History of *Emphor bombiformis*," by John A. Grossbeck, a record of observations made at Arlington, N. J. The account does not in all respects correspond to the observations made on *E. fuscojubatus*, and as it would be interesting to know whether the two behave differently because they are different species or because of difference in the environment, I think, it worth while to call attention to the nature of the discrepancies.

Grossbeck describes the bee as beginning the nest by digging with the fore legs in a thin layer of sod, brushing the fragments away with the hind legs and turning around constantly. When the hole is one-half an inch deep, soil is reached and a different method of working begun. The soil is now moistened with saliva, small pieces bitten off with the mandibles, where, with the assistance of the abdomen, it is placed at the entrance. No doubt the difference in the manner of beginning to dig is due to the difference in the character of the soil, for in the location chosen by E. fuscojubatus there was practically no sod and the bee commenced to work at once on a sandy surface.

The bees at Cape May Point seemed but little disturbed by our presence at any time, except that when reconnoitring at the mouth of the nest, a sudden movement or noise would cause a hasty retreat. We were able to sit quietly very close to the opening without interfering with their comings and goings. On the other hand, the bees at Arlington showed great commotion, flew wildly about, buzzed loudly and were so reluctant to enter their burrows that a group of a little more than twelve were increased to about thirty. Quiet ensued in about five minutes and later in the day

they were not disturbed by human presence. The observer remained, however, about two feet away from the nest openings.

More than once, also, Grossbeck noticed bees showing animosity toward each other. On one occasion when a pollen-laden bee returned to find its burrow already occupied by another, also pollen-bearing, there followed a really dramatic episode. Both came out hurriedly, buzzed around, clenched, rolled on the ground, separated and were then lost to sight. Presently one returned, presumably the rightful owner, and rapidly removed three loads of pollen, two of which were dropped not far from the entrance and the third was carried farther away. The colony of E. fuscojubatus, on the contrary, so far as we could tell lived together, mutually harmonious, yet independent. It is well known that some strains of *Apis mellifica* show much greater excitability and pugnacity than others and it is quite possible that, of these two closely related species, one is more readily moved to fear or wrath than the other.

Exactly at what hour *E. bombiformis* was seen carrying pollen is not stated, but it is to be supposed from the following that it was in the afternoon. Referring to the greater ease with which pollen-laden bees find the entrance, Grossbeck remarks "There was no uncertainty displayed as in the morning hours." This is strikingly different from the habit of *E. fuscojubatus*, which was to collect pollen only in the early morning.

It seems likely that the reason why pollen-laden bees fly so directly to their burrows is that, in the course of frequent trips to and fro during the making of the nest, they have gained a more thorough familiarity with the surroundings. As far as I remember, this directness of flight was not confined to bees bearing pollen.

On Aug. 22, Grossbeck saw bees on a roadside puddle, but was not sure whether they actually lapped up the water or not. A rather strong wind was blowing at the time, by which the insects were constantly swept across the puddle. "They seemed to fly back to the windward side when blown across, for mere sport." I think there can be no doubt that the bees actually do take up the water, because of the regularity of their visits to the pond or puddle, the time that they spend there and the quantity of fluid coming from the mouth, used to moisten the earth and form pellets.[1]

[1] F. Knab reports seeing *E. bombiformis* at the edge of a marsh on the outskirts of Washington, alighting on the surface of the water. They remained usually about 10 sec., the proboscis in contact with the water.—Proc. Wash. Ent. Soc., 1911, p. 170.

Perhaps the most striking difference in the habits of the two species is indicated by the fact that the eggs and larvæ obtained by Grossbeck were dug from open burrows and nothing was seen like a covered burrow. *Emphor fuscojubatus* very plainly makes use of the turret earth and even the ejected pellets for covering the nest not long after oviposition, leaving, however, a nearly circular depression somewhat like the impression of a finger tip in the sand.

That no bees were seen at Arlington after Sep. 3 may very well have been due to unfavorable weather conditions. At Cape May Point some were still active during the first week of September, but how much longer I do not know.

The death rate of the larvæ must be high, for from twenty-one cocoons preserved by Grossbeck he reports as emerging only one male and six females. This took place between July 11 and July 20, although on July 21 no bees were seen in the vicinity of the nesting site. Probably the time of emerging from the cocoon is nearly the same for *E. fuscojubatus*, although I have as yet made no observations on this point.

ANTS COLLECTED IN GEORGIA BY DR. J. C. BRADLEY AND MR. W. T. DAVIS.

By William Morton Wheeler.

The following list is compiled from a large collection of ants made in different parts of Georgia by Dr. J. C. Bradley and a smaller collection made by Mr. W. T. Davis in a more restricted area. I have indicated the names of these collectors by their initials for each locality.

Family Formicidæ.

Subfamily Ponerinæ.

1. *Stigmatomma pallipes* Haldem.—Clayton (J. C. B.); Black Rock Mt., Rabun Co. (W. T. D.).
2. *Ponera trigona* Mayr var. *opacior* Forel.—Gainesville and Billy's Island, Okefenokee Swamp (J. C. B.).
3. *Ponera opaciceps* Mayr.—St. Simon's Island (J. C. B.).
4. *Ponera coarctata* Latr. subsp. *pennsylvanica* Buckley.—Spring Creek, Burton, Thalman and Atlanta (J. C. B.).

5. *Odontomachus hæmatoda* L. subsp. *insularis* Guérin.—Bainbridge, Ducker, Spring Creek and Billy's Island, Okefenokee Swamp (J. C. B.).

Subfamily Dorylinæ.

6. *Eciton* (*Acamatus*) *opacithorax* Emery.—Darien (J. C. B.); Clayton (W. T. D.).

Subfamily Myrmicinæ.

7. *Pseudomyrma brunnea* F. Smith.—Bainbridge, Cumberland, St. Simon's Island and Billy's Island, Okefenokee Swamp. (J. C. B.).
8. *Pseudomyrma pallida* F. Smith.—Spring Creek and Tybee Island (J. C. B.).
9. *Pseudomyrma flavidula* F. Smith.—Ogelthorpe and Billy's Island, Okefenokee Swamp (J. C. B.).
10. *Myrmecina graminicola* Latr. subsp. *americana* Emery.—Gainesville (J. C. B.).
11. *Myrmica scabrinodis* Nyl. var. *schencki* Emery.—Clayton (W. T. D.).

12. **Leptothorax bradleyi** sp. nov.

Worker. Length 2.6 mm.

Head rather large, subrectangular, a little longer than broad, with straight, parallel sides and feebly excised posterior border. Eyes rather small, at the middle of the sides of the head. Mandibles and clypeus moderately convex, the latter with straight, entire anterior border. Frontal area small and indistinct. Antennæ 11-jointed; scapes reaching half way between the eyes and the posterior corners of the head; funiculi with a 3-jointed club; first funicular joint as long as the three succeeding joints together; joints 2–6 much broader than long, joint 7 as long as broad; terminal joint longer than the two penultinate joints together. Thorax rather robust, narrower than the head, broader in front than behind, but as high behind as in front, with flattened dorsal and lateral surfaces and rather angular humeri, without any traces of a mesoëpinotal constriction. Epinotal spines stout, as long as broad at their bases, laterally compressed, suddenly tapering at their tips, directed backward and slightly upward, further apart at their bases than long. Petiole from above about $1\frac{1}{2}$ times as long as broad, pyriform, with rounded sides; its node in profile with feebly concave anterior and decidedly convex posterior slopes, meeting with a distinct transverse ridge, the lower border in profile feebly concave and with a small, compressed anterior tooth. Postpetiole from above transversely elliptical, slightly broader than the petiole, slightly broader than long, in profile smaller than the petiole, as long as high, with evenly rounded, convex node. Gaster elongate elliptical, its sides rather straight, its anterior border excised in the middle. Legs stout, with incrassated femora.

Head, including the mandibles, thorax, petiole, postpetiole and antennæ opaque; gaster and legs shining. Mandibles finely longitudinally striated. Clypeus coarsely longitudinally rugose, on the sides reticulately rugose. Head above and on the sides finely and evenly longitudinally rugose, with the interrugal spaces reticulate-punctate. Thorax, petiole and postpetiole densely punctate, the thorax also reticulately and longitudinally rugose both on the dorsal and pleural surfaces.

Hairs yellowish, short and rather abundant, clavate and erect on the head, thorax and abdomen, appressed and pointed on the legs and scapes.

Color ferruginous red; antennæ, legs and gaster, except the posterior borders of the segments, somewhat paler; mandibular teeth black.

Described from a single specimen taken by Mr. J. C. Bradley on Billy's Island in the Okefenokee Swamp.

In the shape of the body and in coloration, this species is very similar to *L. schaumi* Roger, but differs in the much coarser, longitudinal rugosity of the head and thorax, much larger and differently shaped epinotal spines and in the shape of the petiolar node, the sides and posterior declivity of which are much more convex and rounded. From *L. fortinodis* Mayr., *bradleyi* differs in these same characters, except the shape of the petiole, and in the paler coloration.

13. *Leptothorax curvispinosus* Mayr.—Atlanta and Clayton (J. C. B).
14. *Leptothorax* (*Dichothorax*) *pergandei* Emery.—Atlanta (J. C. B.).
15. *Pogonomyrmex badius* Latr.—Bower Station, Albany, Bainbridge, Spring Creek, Tybee Island, St. Simon's Island and Billy's Island, Okefenokee Swamp (J. C. B.).
16. *Aphœnogaster lamellidens* Mayr.—Gainesville, Spring Creek and Thunderbolt (J. C. B.).
17. *Aphœnogaster treatæ* Forel.—Tallulah Falls, Clayton and Black Rock Mt., 2000–3500 ft. (J. C. B.).
18. *Aphœnogaster treatæ* Froel var. *ashmeadi* Emery.—Atlanta and St. Simon's Island.
19. *Aphœnogaster fulva* Roger.—Black Rock Mt., Spring Creek and Gainesville (J. C. B.).
20. *Aphœnogaster fulva* Roger subsp. *aquia* Buckley.—Summerville, Tallulah Falls, Clayton, Atlanta, Black Rock Mt., and Billy's Island, Okefenokee Swamp (J. C. B.).
21. *Aphœnogaster tennesseensis* Mayr.—Clayton (J. C. B. and W. T. D.).

22. *Monomorium minimum* Buckley.—Cave Springs, Spring Creek, Atlanta, Thunderbolt and Billy's Island, Okefenokee Swamp (J. C. B.).
23. *Monomorium pharaonis* L.—Albany (J. C. B.).
24. *Crematogaster ashmeadi* Mayr.—Gainesville and Atlanta (J. C. B.).
25. *Crematogaster lineolata* Say.—Oglethorpe, and Billy's Island, Okefenokee Swamp, Atlanta (J. C. B.).
26. *Crematogaster lineolata* Say var. *lutescens* Emery.—Athens, St. Simon's Island, Tallula Falls, Gainesville, Fitzgerald and Billy's Island, Okefenokee Swamp (J. C. B.).
27. *Crematogaster lineolata* Say var. near *lutescens* Emery.—Tallulah Falls, Spring Creek, Black Rock Mt. and Gainesville (J. C. B.).
28. *Crematogaster lineolata* Say var. *subopaca* Emery.—Black Rock Mt. (J. C. B.).
29. *Crematogaster lineolata* Say subsp. *subpilosa* Pergande.—Clayton, 2000–3500 ft. (W. T. D.).
30. *Solenopsis geminata* Fabr.—St. Simon's Island, Spring Creek, Waycross and Billy's Island, Okefenokee Swamp (J. C. B.).
31. *Pheidole vinelandica* Forel.—Clayton and Gainesville (W. T. D.).
32. *Pheidole tysoni* Forel.—Tallulah Falls (J. C. B.); Clayton (W. T. D.).
33. *Pheidole metallescens* Emery.—Thunderbolt and St. Simon's Island (J. C. B.).
34. *Pheidole dentata* Mayr.—Cornelia (W. T. D.).
35. *Pheidole dentata* Mayr. var. *faisonica* Forel.—Tallulah Falls (J. C. B.).
36. *Pheidole dentata* Mayr. var.—St. Simon's Island, Tybee Island, Gainesville and Spring Creek (J. C. B.).
37. *Pheidole crassicornis* Emery.—Bainbridge (J. C. B.).
38. *Pheidole crassicornis* Emery var.—Black Rock Mt. (J. C. B.).
39. *Atta* (*Trachymyrmex*) *septentrionalis* MacCook.—Bainbridge and Spring Creek (J. C. B.).

Subfamily Dolichoderinæ.

40. *Dolichoderus* (*Hypoclinea*) *mariæ* Forel.—Toccoa and Clayton (J. C. B.).

41. *Dolichoderus* (*Hypoclinea*) *pustulatus* Mayr. var. *beutenmuellerl* Wheeler.—Cornelia (W. T. D.).
42. *Dorymyrmex pyramicus* Roger.—Atlanta, Ducker and Gainesville (J. C. B.).
43. *Dorymyrmex pyramicus* Roger var. *flavus* MacCook.—Spring Creek, Gainesville, Thunderbolt and Atlanta (J. C. B.).
44. *Iridomyrmex pruinosus* Roger.—Tybee Island, Savannah and Billy's Island, Okefenokee Swamp (J. C. B.).
45. *Iridomyrmex pruinosus* var. *analis* Ern. André.—Atlanta and Gainesville (J. C. B.).
46. *Tapinoma sessile* Say.—Waycross and Spring Creek (J. C. B.).

Subfamily Camponotinæ.

47. *Prenolepis imparis* Lay.—Clayton, 2000–3700 ft. (W. T. D.).
48. *Prenolepis imparis* Lay var. *testacea* Emery.—Gainesville. Tybee Island, Marietta and Atlanta (J. C. B.).
49. *Prenolepis* (*Nylanderia*) *longicornis* Latr. Bainbridge; "a very annoying pest and excessively abundant" (J. C. B.).
50. *Prenolepis* (*Nylanderia*) *arenivaga* Wheeler.—Spring Creek (J. C. B.).
51. *Prenolepis* (*Nylanderia*) *vividula* Nyl.—Gainesville and Billy's Island, Okefenokee Swamp (J. C. B.).
52. *Lasius niger* L. var. *americanus* Emery.—Gainesville and Tybee Island (J. C. B.).
53. *Lasius* (*Acanthomyops*) *murphyi* Forel.—Clayton (J. C. B.).
54. *Lasius* (*Acanthomyops*) *interjectus* Mayr.—Gainesville (J. C. B.).
55. *Formica truncicola* Nyl. subsp. *integra* Nyl.—Atlanta and Stone Mt. (J. C. B.).
56. *Formica truncicola* Nyl. subsp. *obscuriventris* Mayr.—Clayton (W. T. D.).
57. *Formica difficilis* Emery var.—Clayton (W. T. D.).
58. *Formica fusca* L. var. *subsericea* Say.—Black Rock Mt. and Spring Creek (J. C. B.).
59. *Formica* (*Neoformica*) *pallidefulva* Latr.—Tallulah Falls, Marietta, Ducker, Clayton, Clarkesville, Atlanta and Black Rock Mt. (J. C. B.).
60. *Formica* (*Neoformica*) *pallidefulva* Latr. subsp. *schaufussi* Mayr.—Black Rock Mt. (J. C. B.).

61. *Formica* (*Neoformica*) *pallidefulva* Latr. subsp. *schaufussi* Mayr. var. *dolosa* Wheeler—Clayton (W. T. D.).
62. *Formica* (*Neoformica*) *pallidefulva* Latr. subsp. *nitidiventris* Emery var. *fuscata* Emery—Thunderbolt and Savannah (J. C. B.).
63. *Camponotus socius* Roger.—Spring Creek, Ducker and Darien (J. C. B.).
64. *Camponotus abdominalis* Roger subsp. *floridanus* Buckley.—Bainbridge, Brunswick, St. Simon's Island, Tybee Island, Spring Creek, Honey Island and Billy's Island, Okefenokee Swamp (J. C. B.); St. Mary's (O. Bangs).
65. *Camponotus castaneus* Latr.—Tallulah Falls and Waycross (J. C. B.).
66. *Camponotus castaneus* Latr. subsp. *americanus* Mayr.—Summerville, Black Rock Mt. and Billy's Island, Okefenokee Swamp (J. C. B.).
67. *Camponotus herculeanus* L. subsp. *pennsylvanicus* DeGeer.—Clayton (W. T. D.); Bainbridge, Summerville, Vienna, Cave Springs, Spring Creek and Blackspear (J. C. B.).
68. *Camponotus herculeanus* L. subsp. *pennsylvanicus* DeGeer var.—Gainesville (J. C. B.).
69. *Camponotus fallax* Nyl. var. *nearcticus* Emery.—Burton, Clayton and Billy's Island, Okefenokee Swamp (J. C. B.).
70. *Camponotus fallax* Nyl. subsp. *discolor* Emery.—"Georgia" (J. C. B.).
71. *Camponotus fallax* Nyl. var. near. *decipiens* Emery.—Athens (J. C. B.); Clayton, 2000–3700 ft. (W. T. D.).
72. *Camponotus* (*Colobopsis*) *impressus* Roger.—Spring Creek and St. Simon's Island (J. C. B.).

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